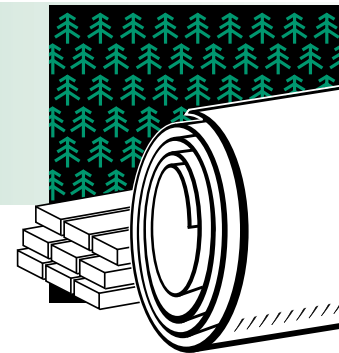


# FOREST PRODUCTS

## Project Fact Sheet



### CORROSION IN KRAFT DIGESTERS: CHARACTERIZATION OF DEGRADATION AND EVALUATION OF CORROSION CONTROL METHODS

#### BENEFITS

- Decreases costs of corrosion
- Decreases corrosion rates and the occurrence of stress corrosion cracking
- Provides recommendations for stronger, more-corrosion resistant materials
- Improves monitoring techniques
- Increases reliability
- Simplifies repairs and lowers maintenance costs

#### APPLICATIONS

Kraft pulp mill operators throughout the industry seek a better understanding of corrosive conditions and corrosion-resistant materials in kraft digesters. The results of this project will be transferred directly to industrial representatives at meetings, through written reports distributed by advisory groups, and through TAPPI and AF&PA.

### METHODS THAT CONTROL CORROSION IN DIGESTERS WILL SIGNIFICANTLY IMPROVE THE INDUSTRY'S COMPETITIVENESS

Corrosion can be a significant problem in kraft digesters, but it does not occur in a continuous, predictable manner. Information obtained from digester operators indicates there may be subtle changes in the chemical conditions in the digester that lead to corrosion or stress corrosion cracking. The latter situation can result in catastrophic failure of digesters. Other types of corrosion include pitting and preferential attack of welds. All of these corrosion problems lead to inefficient digester operation and higher costs to industry. Better technologies to monitor and control corrosion of digester shells would help the pulp and paper industry increase production efficiency.

Researchers at Oak Ridge National Laboratory (ORNL) and at several collaborating institutions will model the chemical reactions that occur inside digesters to provide insight into the chemical environment. This model will also include the effects of fluid flow, which delivers the corrosives to the wall and pipes of digesters, and temperature gradients, which influence corrosion rates. The results of these studies will be used to select superior materials and monitoring techniques for kraft digesters. Control of corrosion will enhance the competitiveness of the U.S. pulp and paper industry, increase the reliability and simplify the maintenance of production equipment, improve safety in kraft mills, and significantly lower industry's costs.

#### METHODS TO CONTROL CORROSION



Figure 1. A digester specialist at Weyerhaeuser Company operates electrochemical noise equipment at Oak Ridge National Laboratory as part of an investigation of corrosion rates in simulated digester environments.



## Project Description

**Goal:** To advance understanding of the chemical and physical processes encountered in both continuous and batch digesters and, as a result, to identify optimum materials and monitoring techniques to control general and localized corrosion.

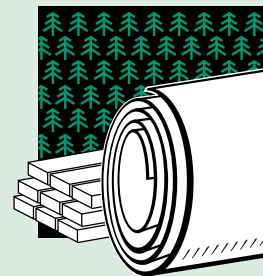
The project will consist of both modeling and experimental efforts to clarify the nature of corrosion in digesters. Researchers will examine the corroded components, evaluate samples from the digesters, and conduct laboratory experiments that simulate digester operations. Several models will be constructed, including one based on a computational fluid dynamics theory of flow within the digester. This model will be aimed at identifying phenomena that can concentrate corroding agents against the walls, pipes, or partitions in the digester. The effort will consist of the following four tasks:

1. Evaluation of corrosion problems for current materials
2. Real-time monitoring of corrosion and real-time characterization of environmental conditions in operating digesters
3. Mathematical modeling
4. Evaluation of alternate materials

During the last task, alternate materials will be evaluated within an operating digester and corrosion measurements will be conducted in the field.

## Progress & Milestones

- Electrochemical noise (ECN) probes are generating data continuously with no problems at Mill #1. Results suggest only modest general corrosion with relatively short-lived events associated with more intense corrosion.
- Researchers will install ECN probes at several locations in a Mill #2's batch digester.
- Several laboratory investigations were initiated. Results suggest:
  - Composition of the passive film is different from typical oxides that form on steel;
  - The technique used for coating a digester influences the layer's uniformity and resistance to penetration by liquor components;
  - Corrosivity cannot be predicted based on the concentration of the major individual chemicals; and
  - Specific wood species and residuals are major influences on steel corrosion.
- Future plans include identifying other appropriate mills for probe installation, expanding lab testing, and launching the mathematical modeling effort.



### PROJECT PARTNERS

Institute of Paper Science  
and Technology  
Atlanta, GA

Paprican, Pulp and Paper Research  
Institute of Canada  
Vancouver, BC

M.J. Schiff and Associates  
Upland, CA

University of British Columbia  
Vancouver, BC

Oak Ridge National Laboratory  
Oak Ridge, TN

Weyerhaeuser Company  
Tacoma, WA

International Paper  
Purchase, NY

Westvaco Corporation  
New York, NY

### FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Valri Robinson  
Office of Industrial Technologies  
Phone: (202) 586-0937  
Fax: (202) 586-3237  
E-mail: [valri.robinson@ee.doe.gov](mailto:valri.robinson@ee.doe.gov)

Dr. Steven J. Pawel  
Oak Ridge National Laboratory  
P.O. Box 2008  
Oak Ridge, TN 37831-6156  
Phone: (865) 574-5138  
E-mail: [pawelsj@ornl.gov](mailto:pawelsj@ornl.gov)

Dr. James Keiser  
Oak Ridge National Laboratory  
Metals and Ceramics Division  
P.O. Box 2008  
Oak Ridge, TN 37831-6156  
Phone: (865) 574-4453  
E-mail: [keiserjr@ornl.gov](mailto:keiserjr@ornl.gov)

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Office of Industrial Technologies  
Energy Efficiency and  
Renewable Energy  
U.S. Department of Energy  
Washington, D.C. 20585



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